Dangers of Water Pollution and Conducting Water Tests

Objective: First, students will learn about and comprehend the scarcity of clean water on our planet and grasp why it is essential to protect our water. Second, students will understand the dangers that polluted water poses to humans. Finally, students will learn about civic activism and how they can play a vital role in identifying water pollution through a practical activity that gives students the opportunity through the scientific method to draw hypotheses, collect information from a water test, analyze it, and form their own conclusions.

Materials: Flipcharts

1-Liter Water Bottle

Water-Measuring Tool (Either a measuring cup or a measuring instrument from the

science classroom)

Three large glasses (preferably clear)

Flipchart Markers

A4 Paper (enough for the whole classroom)

Hole puncher

Colored Paper

4 Envelopes

Preparation: Before the lesson, create approximately 120 hole punches. In this lesson, there will be an activity where students must gather information from a simulated water test and put this information into a graph. These 120 hole punches will be divided among 4 groups of students so that each group has about 30 hole punches. These hole punches must represent 13 different chemicals. Represent them as follows:

Red (Pollution) – Chloride

Red with a black dot – Nitrite

Red with a black line – Nitrate

Red with a black X – Sulfate

Red with a black circle – Pesticide

Red with a black 1 – Acid Rain

Green (Old Pipes) – Copper

Green with a black dot – Lead

Orange (Water Treatment) – Chlorine

Purple (Dirty Soil and Waste) – Hydrogen sulfide

Blue – Alkalinity

Gray – Iron

Yellow – Hardness

It should be noted that 30 hole punches will be collected into four envelopes, and these envelopes will be distributed to the four groups. Please note, when distributing these to the four groups, please make sure that two chemicals make up the vast majority so that it will be easy for the students to identify the contaminants in their water. For example, give Group 1 mostly Nitrate and Copper. Group 2 will get Chlorine and Lead. Group 3 will have a lot of Hydrogen sulfide and pesticides. And perhaps, Group 4 will have a lot of Acid Rain and Chloride. Please note that the dots have been color-coded so that it will be easy to see that some of these chemicals come from the same source when they contaminate the water. For example, all the red dots come from some form of human pollution.

Warm-Up: Begin the PowerPoint about Water Pollution. At the very beginning, **brainstorm** with the children about water. What do we use water for? Why do we need it? Why is it important? Where do we get it from? Feel free to record their answers on the board or on a flipchart. Once you have brainstormed with the children, reveal to them the answers that are on the PowerPoint in the first 8 slides. *This portion should take about 5 minutes.*

Introduction of New Material: **Part 1 -** Next, when you proceed to Slide 9 in the PowerPoint, talk about how important water is for our lives. We use it for many different things. But at this point, ask them how much water is on the planet. Record their responses on the board or on a flipchart. Once they have given their answers, reveal the correct answer in Slide 10. Yes! The truth is that there is a lot of water on our planet. Unfortunately, however, as seen in Slide 11, most of this water is salt water.

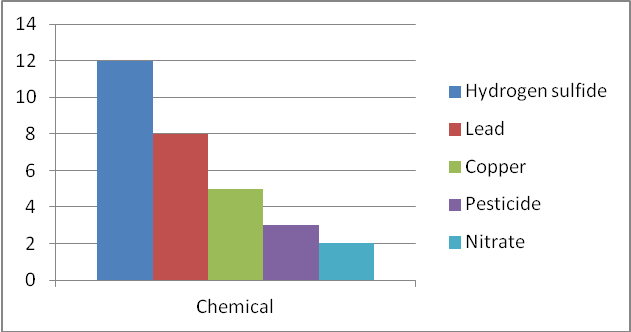
Before you tell them that most of this water is salt water, take the liter of water. As you are talking about how much usable water is on the planet, you will make it more visual by demonstrating with the liter of water. **First**, pour out 970 milliliters of water, and ask the students if they would like a taste. Then, tell them that they can’t! Why? Because **97%** of the world’s water is salt water in oceans and seas and is not available for drinking. **Second**, pour out 16 milliliters of water. Ask them if they want a taste for a second time. This time, say that they still cannot because 1.6% of the world’s water is frozen in ice caps, so we can’t use that either. **Third**, pour out about 3.6 milliliters. Ask them if they want to try again. Again, say that they cannot because the water is too deep underground! **Finally**, ask them if they want to drink the remaining 0.4 milliliters. Of course, this water is clean, but there is not a lot of it. Use this to emphasize that there is fresh water in the world, but we need to take care of it because there is so little of it. During this whole time, use the pie graphs to help you illustrate the percentages of available water. *This portion should take about 5-10 minutes*.

**Part 2** – Next, just follow the PowerPoint to talk about the different sources of pollution. The chemicals in each of these sections have been color-coded to make it easier to understand that many of these chemicals come from the same sources. For example, all the chemicals in red are ones that are a result of human pollution. All chemicals in green are chemicals that are from old pipes. Of course, some of these overlap. Some chemicals in red are also from purple sources as well. This section can get technical, so you do not have to get too specific. Just emphasize the following points: what is the source of the pollutant in the water, what these pollutants are, and what they can do to you. Don’t worry, there is an accompanying table in Ukrainian about all of the chemicals, where they come from, and what they can do to you. *This portion should take about 10-15 minutes.*

Practice of New Material: Once you have introduced the chemicals, now is the time to ask the children whether they think that this is a problem in Ukraine. Brainstorm about what could be in Ukrainian water. Once you have asked students about this, play the short video in Slide 23. There is a Ukrainian translation that you can distribute to your students as well. *This should take about 5 minutes.*

Once the video has been viewed, tell the students that water quality is a problem here. For the free practice, ask them what they can do to solve this problem. At this time, tell them that we need scientists to fix this problem. Right now, they will be scientists, and they will have the opportunity to test their water. Like real scientists, they must make predictions about what could be in the water. Distribute the *Graph Worksheet* to each of the students. Follow the following procedure:

1. Divide the students into 4 groups
2. Give each group an envelope that contains 30 hole punches. Make it so that a certain chemical or two shows up predominantly in these samples.
3. Ask them to count each pollutant piece and make a graph, as if they are real scientists.
4. Let them present their graphs if time permits. They should say what they found in the water, where it comes from, what it could do to you, and where it could have come from.



*This should take about 10-15 minutes*.

Closing: At the very end, tell the students that you will be testing the water in the community. Do they think that the water is clean? What could be in it? What will the result be?

**Sources**

The lesson plan Dangers of Water Pollution and Conducting Water Tests was arranged by ***James F. Genovese*** and all associated translations were done by ***Zhanna Madych***. As this lesson plan was arranged, some of the ideas and graphics used in this lesson have their origin in other sources. Please see the document entitled “Water Lesson Plan Sources” for more information.

“Dangers of Water Pollution and Conducting Water Tests”

1. Ideas from the actual lesson plan were retrieved and adapted from existing lesson plans on the Peace Corps Ukraine Environmental Working Group website, at <http://ewgukraine.wikispaces.com/Educational+Resources>. The specific lesson plans are entitled “Understanding Water as a Resource” and “Pollution: Human Impact on the Environment and Different Kinds of Water Pollution.”

“Water Pollution” PowerPoint and Chemical Chart

1. Some of the ideas from this PowerPoint were also retrieved from the “Understanding Water as a Resource” and “Pollution: Human Impact on the Environment and Different Kinds of Water Pollution” lesson plans. These are retrievable at the above link.
2. “How Much Water Is There on Earth.” How Stuff Works?. <http://science.howstuffworks.com/environmental/earth/geophysics/question157.htm>
3. Information and figures about Total Nitrite, Copper, Lead, and Total Nitrate obtained from the US Environmental Protection Agency’s webpage “Drinking Water Contaminants” located at <http://water.epa.gov/drink/contaminants/index.cfm#3>
4. Information and figures about pH, Total Alkalinity, Iron, Chloride, Sulfate, and Total Hardness obtained from “Water Quality: Protecting Household Drinking Water” located at <http://animalrangeextension.montana.edu/LoL/Module-3b/3-Mineral2.htm>
5. Information about Pesticides obtained from <http://psep.cce.cornell.edu/facts-slides-self/facts/pes-heef-grw85.aspx>
6. Chlorine information taken from <http://www.orthomolecular.org/library/jom/2000/articles/2000-v15n02-p089.shtml>
7. Information about Hydrogen sulfide obtained from <http://www.freedrinkingwater.com/water-education2/78-hydrogen-sulfide.htm>
8. Water video entitled “Quality Drinking Water Scarce in Ukraine” was obtained from <http://www.youtube.com/watch?v=Ittls2Jsguk> and was uploaded by NTD Television.